



(10) Patent No.: US 6,240,307 B1
(45) Date of Patent: *May 29, 2001

- (58) **Field of Search** 128/639, 642,
128/734, 696; 607/116, 119, 122, 123,
125-128; 600/372, 374, 509, 547

- (56)
- References Cited**

- U.S. PATENT DOCUMENTS

- | | | | | |
|-----------|---|---------|---------------------|---------|
| 4,522,212 | * | 6/1985 | Gelinas et al. | 128/642 |
| 4,649,924 | * | 3/1987 | Taccardi | 128/642 |
| 4,660,571 | * | 4/1987 | Hess et al. | 128/642 |
| 4,699,147 | * | 10/1987 | Chilson et al. | 600/374 |
| 4,911,174 | * | 3/1990 | Pederson | 128/695 |
| 4,922,912 | * | 5/1990 | Watanabe | 128/642 |
| 5,025,786 | * | 6/1991 | Siegel | 128/642 |
| 5,156,151 | * | 10/1992 | Imran | 128/642 |
| 5,297,549 | * | 3/1994 | Beatty et al. | 128/642 |
| 5,311,866 | * | 5/1994 | Kagan et al. | 128/642 |
| 5,411,025 | * | 5/1995 | Webster, Jr. | 600/374 |

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

FOREIGN PATENT DOCUMENTS

8302742 * 3/1984 (NL) 128/642

* cited by examiner

Primary Examiner—Lee Cohen

(74) *Attorney, Agent, or Firm*—Beck & Tysuer, P.L.L.C.

(57) **ABSTRACT**

A system for mapping electrical activity of a patient's heart includes a set of electrodes spaced from the heart wall and a set of electrodes in contact with the heart wall. Voltage measurements from the electrodes are used to generate three-dimensional and two-dimensional maps of the electrical activity of the heart.

19 Claims, 8 Drawing Sheets

- (21) Appl. No.: 08/387,832

- (22) PCT Filed: Sep. 23, 1993

- (86) PCT No.: **PCT/US93/09015**

§ 371 Date: **May 26, 1995**

§ 102(e) Date: **May 26, 1995**

- (87) PCT Pub. No.: WO94/06349

PCT Pub. Date: Mar. 31, 1994

- (51) Int. Cl.⁷ A61B 5/042

- (52) U.S. Cl. 600/374; 600/509; 607/122

